



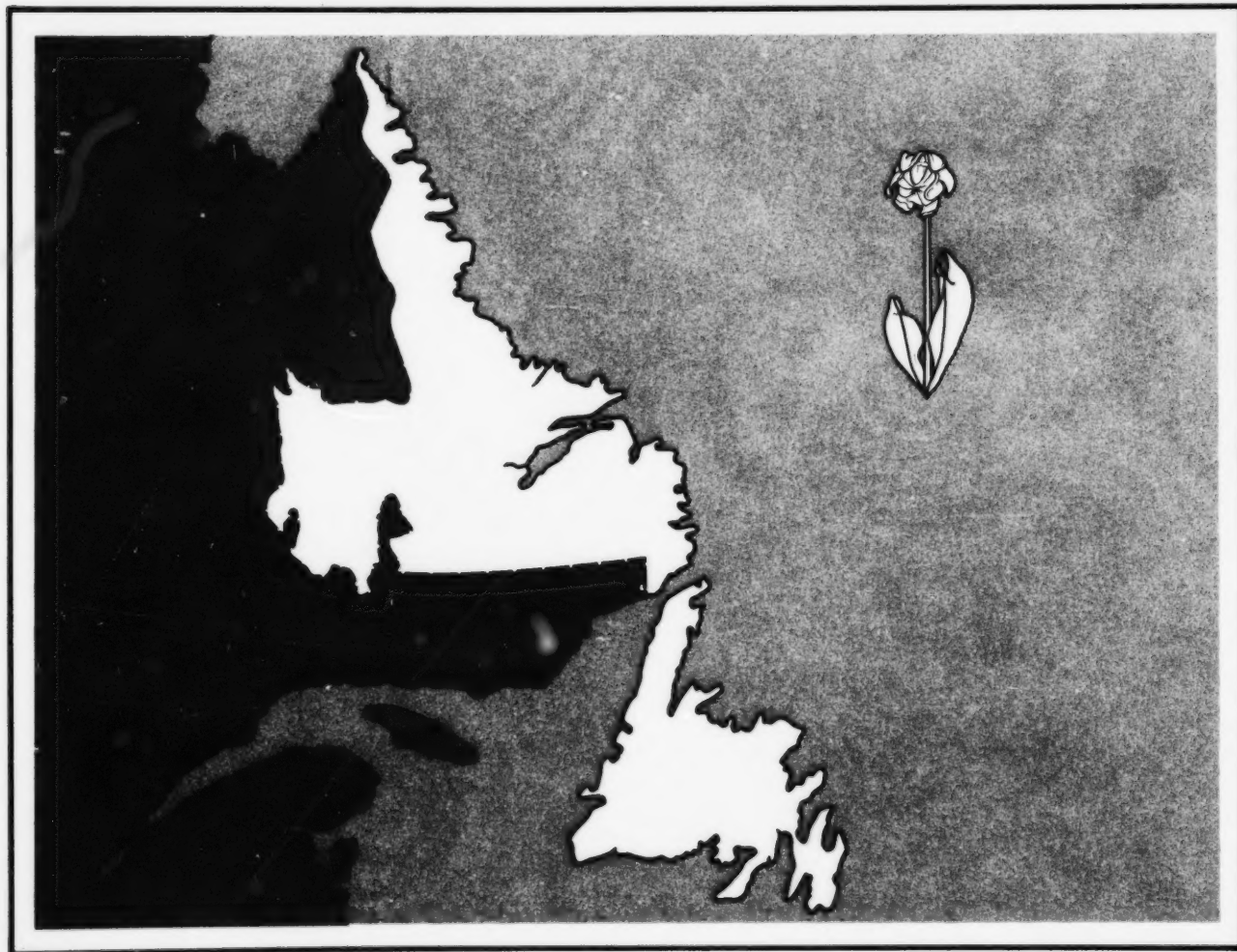
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Soils of the Terra Nova Agricultural Development Area, Newfoundland

Report No. 13
Newfoundland Soil Survey



Canada

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ABSTRACT

Soil and Agricultural capability maps, at a scale of 1:15 840, were produced from the soils information obtained in the soil survey of the Terra Nova Agricultural Development Area. Mineral soils were assessed for their limitations for cole crops, carrots, potatoes and sprinkler irrigation. Organic soils were assessed for fuel peat horticultural peat and vegetable production. This report includes a general description of the area as well as a description of the soils that occurred in the mapped area. A soil map and eight interpretative maps accompanies the report.

RÉSUMÉ

Grâce aux résultats de la prospection pédologique réalisée dans la région de développement agricole de Terra Nova, on a pu élaborer des cartes à l'échelle de 1:15 840, sur les sols et leurs possibilités de production agricole. On a évalué les sols minéraux d'après leur capacité de production des choux marifichers, des carottes et des pommes de terre, et la possibilité d'y utiliser l'irrigation par aspersion. L'évaluation des sols organiques s'est fondée sur leur capacité de production de la tourbe comme combustible ou matériel horticole ainsi que de celle des légumes. Le rapport comprend une description générale de la région ainsi que des sols de la région cartographiée. On y trouve en annexe une carte sur les sols et huit cartes d'interprétation.

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The maps were prepared by the Cartography Section of the Land Resource Research Institute, Central Experimental Farm, Ottawa.

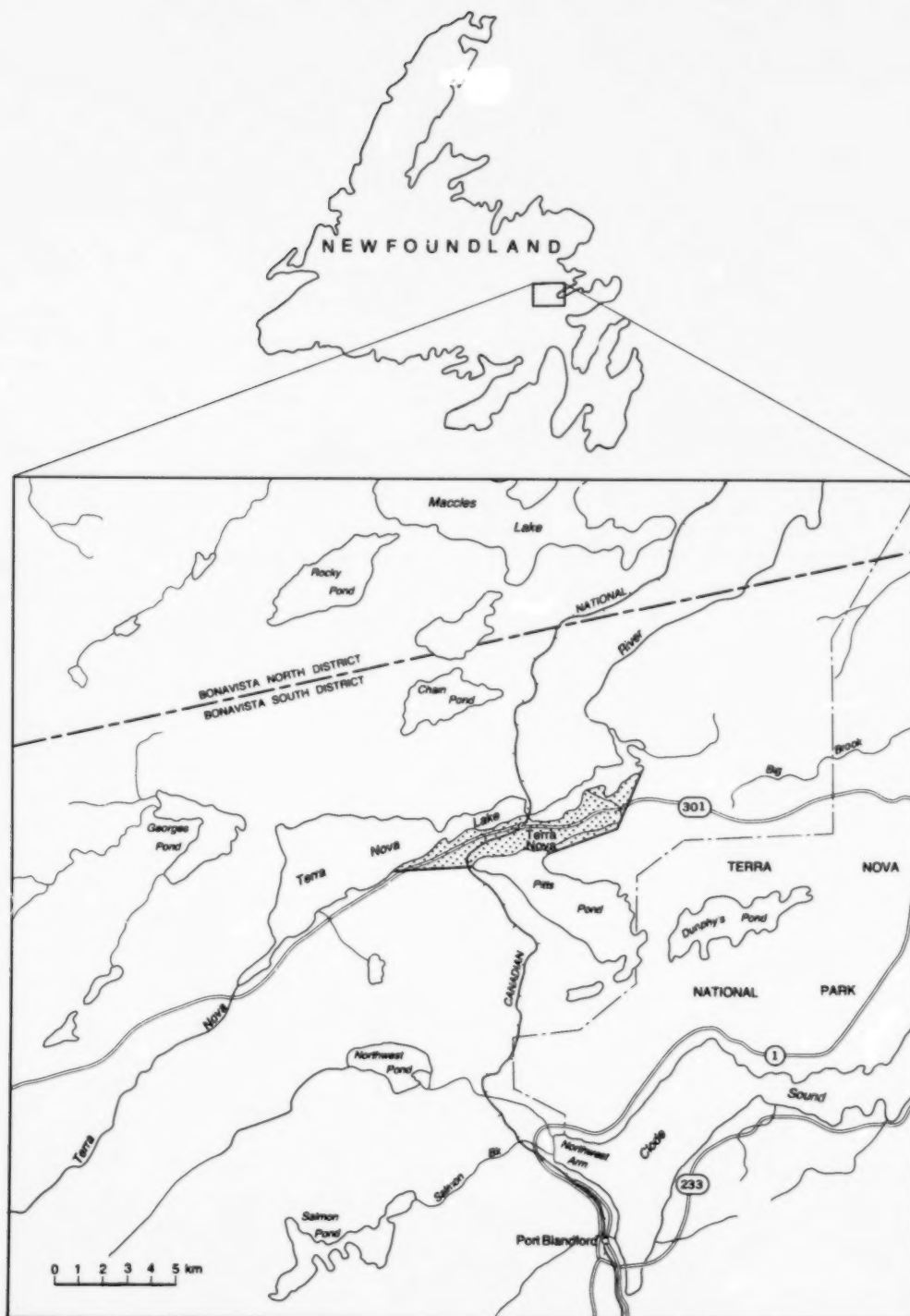


Fig. 1. Map showing the location of the Development Area of Terra Nova.

INTRODUCTION

The soil survey of the Terra Nova Agricultural Development Area was initiated to provide soils information to verify the Provincial Government's proposed Agricultural Development Area (ADA) boundaries. The ADA program was implemented to preserve agricultural land. Land uses not compatible with agriculture would be restricted or tightly controlled under this program.

Soil and agricultural capability maps were produced from the soils information obtained. Another product of this soil survey was the application and testing of soil limitation classification for various uses. Mineral soils were assessed for their limitations for cole crop, carrot, and potato production and for sprinkler irrigation. Organic soils were evaluated for their limitations for fuel peat, horticultural peat and vegetable production.

GENERAL DESCRIPTION OF THE AREA

Location and extent

The Terra Nova Agricultural Development Area soil survey covers an area of 1 035 ha. It lies west of the western boundary of Terra Nova National Park and encompasses the community of Terra Nova (Fig. 1).

History and land use

The Terra Nova area was originally developed by the Anglo Newfoundland Development Company Limited as a loading site for pulpwood that was supplied by a number of logging camps in the area. This activity ended in the late 1950's after which the population declined. According to the 1976 census, the community of Terra Nova had a population of 88 people.

Now, the only enterprise in the community is a commercial farm. It is an integrated operation of laying hens (17,000) and vegetables (32 ha). This operation employed 57 full- and part-time workers in 1980 (Fig.2).

The area has since become popular for summer cabins and camping. There are a number of sandy beaches and ponds that provide excellent swimming. It is also an excellent area for hunting moose and caribou and for fishing.



Fig. 2. An aerial view of a part of the survey area showing Pineland Farms.

Physiography and vegetation

The Terra Nova Agricultural Development Area is situated on glaciofluvial material deposited during the Wisconsin period about 8,000-10,000 years ago. A number of discontinuous eskers occur in the area. One provides a base for a woods road (Fig. 3), and others provide a source of gravel.

A stony glacial till derived from granites, shale, siltstone, and sandstone borders the glaciofluvial deposits on three sides. The north side is bordered by Terra Nova Lake.

The land surface varies from undulating to rolling with a number of waterfilled and peat-filled kettle holes. The sandy glaciofluvial deposits make excellent beaches around the ponds.

Large surface boulders that occur in two areas were probably the result of a re-advance of the ice sheet, depositing till material over the glaciofluvial material. It has also resulted in soils somewhat more fine-textured than the normal.

The area is sparsely treed with a poor growth of black spruce. Red pine and white pine occur in the area. The dominant ground cover is caribou moss and Kalmia sp. A good growth of balsam fir occurs on the morainal till.



Figure 3. An esker used for a roadbed.

Climate

Weather data were recorded at the Gander weather station located 25 km northwest from the surveyed area. The climatic data has been extracted from Canadian Climatic Normals (1941-1970) of the Atmospheric Environment Service (Table 1).

Table 1. Temperature and precipitation for the growing season, Gander weather station (147 m above MSL; 30 year observation).

Temp °C	May	June	July	August	Sept	Oct
Mean daily	6.4	11.4	16.5	15.8	11.8	6.3
Mean daily max.	11.2	16.9	21.9	20.6	16.3	10.2
Mean daily min.	1.4	5.9	11.1	11.1	7.2	2.4
Precipitation (mm)						
Mean total	63	76	78	100	84	95
No. of days with measurable rain	13	14	13	16	15	15
Average number of frost free days	122					
Average latest spring frost	June 4					
Average earliest fall frost	October 5					

The data indicate temperatures are sufficient for most regionally adapted crops, with little likelihood of frost during the growing season. However, the Terra Nova region, being situated in the Terra Nova River Valley, possibly is subjected to later spring frost and earlier fall frost as a result of cold air settling into the valley.

Precipitation is well distributed throughout the growing season. Moisture deficiencies occur due to the low moisture-holding capacity of the sandy soils.

METHODS OF FIELD INVESTIGATION AND MAPPING

Soils information from the Gander Lake Exploratory Soil Survey (Hender 1984) was extended to delineate the boundary for the Terra Nova Development area. An assessment of the area was made by photo interpretation of 1976 1:12 500 scale color aerial photographs. Preliminary soil boundaries were delineated on a 1:15 840 base map. Obvious landform boundaries were the basis for most soil delineations. Agricultural soil capability assessment was made at a scale of 1:25 000.

Field investigations were carried out during the summer of 1979 to verify the results of the photo interpretation. A total of 65 fieldchecks were made along all accessible roads and trails. Other areas were traversed by foot. Four detailed soil samples were taken in the area. Eight organic soils were sampled during the fall of 1981.

DESCRIPTION OF THE SOILS

The soils of the Terra Nova Agricultural Development Area are grouped into four orders according to the Canadian System of Soil Classification (1978). The four orders represented are Podzolic, Gleysolic, Brunisolic and Organic.

Podzolic soils are the dominant soils in the area developed on glaciofluvial and till material. They are subdivided into Ortstein Humo-Ferric Podzol, Orthic Humo-Ferric Podzol and Gleyed Humo-Ferric Podzol, the former two being well-drained soils. Gleyed Humo-Ferric Podzols show characteristics of periodic wetness in the profile and occur only on the till.

Gleysolic soils occur in low-lying areas generally occupied by stream channels. The development of podzolic characteristics in these soils has been restricted by poor drainage and lack of aeration resulting in soil mottling and dull colours. These soils are inundated for long periods during the year.

Brunisolic soils occur only in the glaciofluvial material where the texture is sand to loamy sand. They are usually rapidly drained and lack the degree or kind of horizon development specified for soils of other orders. The subgroups found were Eluviated Dystic Brunisol and Duric Dystric Brunisol.

Organic soils occur throughout the area. Bogs are the dominant type of wetland class in the survey area. The deeper bogs are classified as Typic Fibrisols and are more than 2 m in depth. The shallow bogs are classified as Terric Humisols. A small area of fens occur, classified as Terric Mesic Humisol.

(Pt) Pitt's Pond soils

Pitt's Pond soils consist of Podzolic and Brunisolic soils developed on coarse-textured, stratified, glaciofluvial deposits. They have a total area of 638 ha.

The parent material is olive brown sand, gravel and cobbles of mixed origin. Textures range from sand to gravelly loamy sand, and may vary throughout the profile because of the stratification in the parent material. Generally these glaciofluvial materials are stone free. However, the few eskers that occur in the area are excessively stony. A thin layer of till with surface boulders occurs on top of the glaciofluvial material in a few locations.

The topography is undulating to hummocky. Ridges occur in areas where eskers exist.

The soils are well to rapidly drained and show signs of droughtiness and the need for irrigation in most years. They are of very low exchangeable base status and very low fertility. The soils have very low organic matter content. On the older fields, where manure has been added annually for the past 20 years, productivity has increased dramatically (Calloway 1979). Soil structure has also improved.

The cementation in the B horizon ranges from weak to strong and often extends to the C horizon. Strong cementation is usually associated with gravelly cobbly soils. Vertical water movement is somewhat restricted by this cementation. Continuous deeper ploughing of these soils will eventually break up the cementation (Calloway 1979). This is evident in some of the older cultivated fields in the area.

These soils have been classified as Ortstein Humo-Ferric Podzols (Fig. 4), Orthic Humo-Ferric Podzol, Eluviated Dystric Brunisol (Fig. 5) and Duric Dystric Brunisol. Brunisols generally develop in soils that are rapidly drained and have a sand to loamy sand texture with no cobbles. Ortstein is associated with coarse-textured soils with gravels and cobbles throughout the profile.

The Pitt's Pond soils are rated Class 4 for agriculture. The soils are droughty because of the sandy loam to sandy textures. Irrigation is required in order to maintain high production (Calloway 1979). The lack of stones and the "flatness" of the land contribute to the rating of this soil as excellent for agricultural use, by Newfoundland standards.

The vegetation on the Pitt's Pond soils consists of a very sparse growth of black spruce and juniper with sheep-laurel and caribou moss (Fig. 6). A good growth of white pine also occurs on these soils.

A detailed description follows of the soil subgroups mapped:



Figure 4. Pitt's Pond soil -
Ortstein Humo-Ferric Podzol

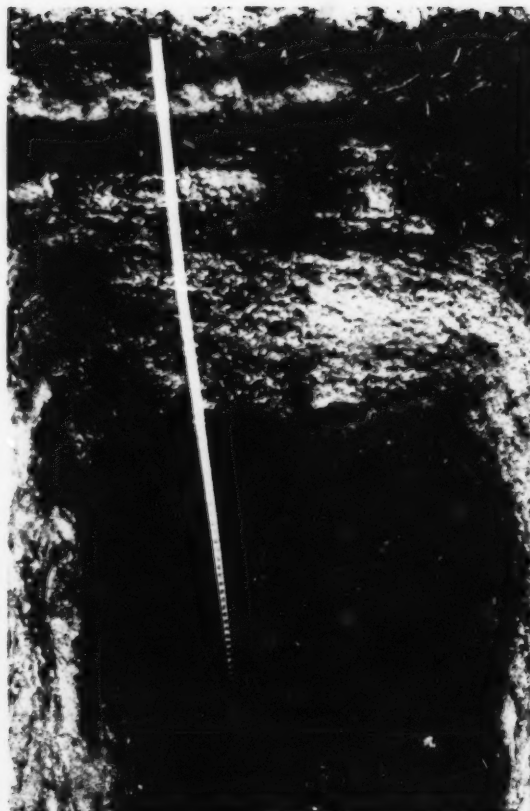


Figure 5. Pitt's Pond soil -
Eluviated Dystric Brunisol



Figure 6. Typical vegetation occurring on the Pitt's Pond soils.

Pitt's Pond soil: Orthic Humo-Ferric Podzol

Vegetation: Black spruce, sphagnum moss, lambkill, caribou moss, juniper, alder, white pine.

Soil site: Parent Material 1: bouldery, cobbly and gravelly sand glaciofluvial material; extremely to strongly acidic; undulating topography with 3% slopes; well drained, rapidly pervious, slow surface runoff, seepage absent; exceedingly stony; nonrocky; present land use: productive woodland.

LF 5 to 0 cm; material composition 60% leaves, 40% needles, slight decomposition; abundant fine horizontal roots; 5-7 cm thick.

Ae 0 to 6 cm; light brownish gray (10YR 6/2 m); gravelly, sandy loam; weak medium and fine, subangular blocky; slightly sticky, very friable, soft, slightly plastic; abundant fine random roots; common very fine continuous pores; 1-7 cm thick.

- Bf 6 to 21 cm; brown (7.5YR 4.5/5 m); sandy loam; weak to moderate, medium and fine, subangular blocky; slightly sticky, friable, soft, slightly plastic; abundant fine roots; many fine continuous pores; cobbly and stony (bouldery) coarse fragments; 12-30 cm thick.
- BC 21 to 31 cm; olive brown (2.5Y 4/4 m); very cobbly, sand; weak, fine, granular; nonsticky, firm, hard, slightly plastic; plentiful fine roots; many fine continuous pores; 60% cobbly and stony (bouldery) coarse fragments; 8-12 cm thick.
- C 31 to 101 cm; olive gray (5Y 4/2.5 m); very cobbly, coarse sand; single grain; stratified; nonsticky, loose, nonplastic; few very fine roots; common fine continuous pores; 60% cobbly and stony (bouldery) coarse fragments.

Chemical properties Pitt's Pond soil: Orthic Humo-Ferric Podzol

Horizon	pH CaCl ₂	Org C (%)	Total N (%)	Exchangeable cations Neutral salt (meq/100g)			C.E.C. (meq/100g)	
				Ca	Mg	Al	Buff. charge	Perm.
LF								
Ae	3.6	0.94	0.05	0.3	0.1	5.7	10.8	
Bf	4.6	2.45	0.10	0.2	0.1	0.5	14.0	
BC	5.2	0.51	0.03	0.1	0.0			4.3
C	5.3	0.17	0.01	0.1	0.0			2.6

Horizon	Extract Iron	Extract Aluminum	Extract Mn
	(%)	(%)	(%)
LF			
Ae	0.1	0.1	0.0
Bf	0.3	0.8	0.0
BC	0.0	0.2	0.0
C	0.0	0.1	0.0

Pitt's Pond soil: Ortstein Humo-Ferric Podzol

Vegetation: Black spruce, juniper, white pine, lambkill, Labrador tea, caribou moss, blueberry.

Soil site: Parent Material 1: weak chemical weathering, fragmental (stones, cobbles and gravel) and stratified (mineral), extremely to strongly acidic (pH.5.5), glaciofluvial; landform classification: glaciofluvial, undulating; slope: 4% slope of Class 3 (2-5%), facing south, site at lower slope position, strongly mounded microtopography; soil moisture and drainage: rapidly drained, moderately pervious, very slow surface runoff, seepage absent; very stony; nonrocky; present land use: productive woodland; humus-form: conifero fibrimor.

LF 10 to 1 cm; material composition 50% leaves and 50% needles; slightly decomposed; plentiful medium horizontal roots; 8-12 cm thick.

H 1 to 0 cm; material composition 50% leaves and 50% needles; highly decomposed; plentiful medium horizontal roots; 0-1 cm thick.

Ae 0 to 12 cm; matrix dry, light gray (5YR 7/1); loamy sand; single grain; nonsticky, loose, nonplastic; plentiful fine horizontal roots; wavy, abrupt boundary; 2 to 15 cm thick.

Bfc 12 to 32 cm; matrix moist, strong brown (7.5YR 5/8); gravelly loamy sand; single grain; nonsticky, very firm, extremely hard, nonplastic; strongly cemented by humus aluminum and iron, discontinuous; abundant micro roots; gravelly coarse fragments; wavy, gradual boundary; 18 to 22 cm thick.

BCc 32 to 67 cm; matrix moist, yellowish brown (10YR 5/8); very gravelly coarse sand; single grain; nonsticky, very firm, extremely hard, nonplastic; strongly cemented by humus aluminum and iron, discontinuous; very few micro roots; gravelly and cobbly and stony (bouldery) coarse fragments; wavy, gradual boundary; 30 to 38 cm thick.

C 67 to 117 cm; matrix moist, reddish brown (2.5Y 4/4); very gravelly coarse sand; single grain; nonsticky, loose, nonplastic; very few micro roots; gravelly, cobbly and stony (bouldery) coarse fragments.

Chemical properties Pitt's Pond soil: Ortstein Humo-Ferric Podzol

Horizon	pH	Org C (%)	Total N (%)	Exchangeable cations			C.E.C. (meq/100g)	
	CaCl ₂			Neutral salt (meq/100g)			Buff. charge	Perm. charge
				Ca	Mg	Al		
LF								
H								
Ae	3.4	0.44	0.02	0.1	0.0	1.2	2.8	
Bfc	5.6	1.95	0.05	0.1	0.2	0.1		7.7
BCc	5.4	0.36	0.01	0.0	0.0		2.6	
C	5.2	0.23	0.00	0.1	0.0		1.6	

Horizon	Extract Iron	Extract Aluminum	Extract Mn
	(%)	(%)	(%)
LF			
H			
Ae	0.0	0.0	0.0
Bfc	0.2	0.6	0.0
BCc	0.0	0.2	0.0
C	0.0	0.1	0.0

Pitt's Pond soil: Duric Dystric Brunisol

Vegetation: Poor black spruce, white pine, juniper, willow, lambkill, caribou moss, Labrador tea.

Soil site: Parent Material 1: Weak chemical weathering, stratified (mineral) and sandy, glaciofluvial, mixed and igneous; organic deposit is 0.1 m; landform classification: glaciofluvial, undulating; slope: 3% complex slope of Class 3 (2-5%), level microtopography; soil moisture and drainage: semiarid, rapidly drained, rapidly pervious, very slow surface runoff, seepage absent; nonstony; nonrocky; present land use: unproductive woodland; humus-form: conifero fibrimor.

L	6 to 4 cm; 75% leaves and 25% needles; no decomposition; abundant medium horizontal expd roots; 1-3 cm thick.
H	4 to 0 cm; 75% leaves and 25% needles, highly decomposed; abundant medium horizontal expd roots; 2-4 cm thick.
Ae	0 to 8 cm; sand; single grain; nonsticky, loose, nonplastic; plentiful fine roots; smooth, abrupt horizon; 4-12 cm thick.
Bfcj	8 to 15 cm; gravelly loamy sand; weak, fine, granular; slightly sticky, very friable, soft, slightly plastic; weakly cemented by humus-aluminum and iron, discontinuous; plentiful fine roots; common fine horizontal pores; wavy boundary; 2-8 cm thick.
Bm	15 to 25 cm; gravelly sand; moderate to strong, fine, platy; nonsticky, firm, very hard, nonplastic; strongly cemented by humus-aluminum and iron, discontinuous; few fine roots; common fine pores; gravelly coarse fragments; wavy horizon boundary; 8-12 cm thick.
BCc	25 to 40 cm; gravelly coarse sand; single grain; nonsticky, firm, hard, nonplastic; strongly cemented by humus-aluminum and iron, discontinuous; plentiful very fine roots; gravelly coarse fragments; wavy boundary; 12-20 cm thick.
C	40 to 103 cm; coarse sand; single grain; nonsticky, loose, nonplastic; plentiful micro roots; gravelly coarse fragments; smooth boundary.
IIC	103 to 133 cm; loamy sand; single grain; nonsticky, loose, nonplastic; very few micro roots.

Chemical properties Pitt's Pond soil: Duric Dystric Brunisol

Horizon	pH CaCl ₂	Org C (%)	Total N (%)	Exchangeable cations			C.E.C. (meq/100g)	
				Neutral salt (meq/100g)			Buff. charge	Perm. charge
				Ca	Mg	Al		
Ae	3.4	0.43	0.02	0.1	0.0	1.7	3.3	
Bfcj	4.1	3.32	0.07	0.1	0.1	1.8	19.8	
Bm	5.0	0.62	0.02	0.1	0.1	0.3	6.4	
BCc	5.1	0.26	0.01	0.0	0.0	0.2	2.5	
C	5.2	0.06	0.00	0.0	0.0		1.2	
IIC	5.2	0.00	0.00	0.5	0.2		0.9	

Horizon	Extract Iron	Extract Aluminum	Extract Mn
	(%)	(%)	(%)
Ae	0.0	0.0	0.0
Bfcj	0.2	0.7	0.0
Bm	0.0	0.3	0.0
BCc	0.0	0.1	0.0
C	0.0	0.0	0.0
IIC	0.0	0.0	0.0

Pitt's Pond soil: Eluviated Dystric Brunisol

Vegetation: Poor growth black spruce, lambkill, caribou moss, blueberry.

Soil site: Parent Material 1: weak chemical weathering, sandy, glaciofluvial; parent material 2: sandy, glaciofluvial; organic deposit is 0.1 m; landform classification: glaciofluvial, inclined; slope: 6% simple slope of class 4 (6-9%), facing southwest, site at upper slope position, level microtopography, 200 m long; soil moisture and drainage: semiarid, rapidly drained, rapidly pervious, slow surface runoff, seepage absent; nonstony; nonrocky; present land use: unproductive woodland; humus-form: conifero fibrimor.

- L 2 to 1 cm; 50% leaves and 50% needles; no decomposition; very few roots; 1-2 cm thick.
- H 1 to 0 cm; 50% leaves and 50% needles; highly decomposed; plentiful medium horizontal roots; common fine pores; 1-2 cm thick.
- Ae 0 to 5 cm; light gray (5YR 7/1 m); fine sand; single grain; nonsticky, loose, nonplastic; weakly cemented by humus-aluminum and iron, discontinuous; few medium roots; few fine pores; smooth, abrupt boundary; 2-10 cm thick.
- Bfcj 5 to 8 cm; dark reddish brown (5YR 3/4 m); loamy fine sand; single grain; nonsticky, firm, very hard, nonplastic; weakly cemented by humus-aluminum and iron, discontinuous; plentiful fine roots; few fine pores; wavy, gradual boundary; 2-5 cm thick.
- Bmcj 8 to 28 cm; strong brown (7.5YR 5/8 m); sand; single grain; nonsticky, firm, very hard, nonplastic; weakly cemented by humus-aluminum and iron; plentiful very fine roots; few fine pores; wavy clear boundary; 18-22 cm thick.
- Bmcj2 28 to 40 cm; pale red (2.5Y 6/2 m); sand; single grain; nonsticky, loose, nonplastic; weakly cemented by humus-aluminum and iron, discontinuous; abundant very fine roots; few fine pores; smooth, clear boundary; 10-12 cm thick.
- BCcj 40 to 50 cm; pale red (2.5Y 6/2 m); fine sand; massive; nonsticky, loose, nonplastic; weakly cemented by humus-aluminum and iron; abundant micro roots; common fine pores; smooth, abrupt boundary; 10-13 cm thick.
- C1 50 to 70 cm; gray (5YR 6/1 m); sand; single grain; nonsticky, loose, nonplastic; many fine pores; smooth, abrupt boundary; 15-25 cm thick.
- C2 70 to 130 cm; pinkish gray (7.5YR 7/2 m); gravelly loamy sand; single grain; nonsticky, loose, nonplastic; many fine pores.

Chemical properties Pitt's Pond soil: Eluviated Dystric Brunisol

Horizon	pH CaCl ₂	Org C (%)	Total N (%)	Exchangeable cations			C.E.C. (meq/100g)	
				Neutral salt /meq/100g)			Buff. charge	Perm. charge
				Ca	Mg	Al		
Ae	3.7	0.34	0.01	0.1	0.0	1.4	3.2	
Bfcj	4.7	1.70	0.05	0.1	0.0	0.3	9.7	
Bmcj	5.1	0.34	0.01	0.1	0.0	0.2	3.9	
Bmcj2	5.2	0.08	0.00	0.00	0.00		1.8	
BCcj	5.3	0.06	0.00	0.0	0.0		1.7	
C1	5.4	0.06	0.00	0.0	0.0		1.4	
C2	5.4	0.00	0.00	0.0	0.0		0.8	

Horizon	Extract	Extract	Extract
	Iron (%)	Aluminum (%)	Mn (%)
Ae	0.7	0.0	0.0
Bfcj	0.1	0.5	0.0
Bmcj	0.0	0.2	0.0
Bmjc2	0.0	0.1	0.0
BCcj	0.0	0.1	0.0
C1	0.0	0.1	0.0
C2	0.0	0.0	0.0

Gambo soils

The Gambo soils have been classified as Orthic Humo-Ferric Podzols, Gleyed Humo-Ferric Podzols and Orthic Gleysols. The parent material is glacial till composed of roughly equal parts of granite and of metamorphosed fine-grained sedimentary rocks. The Gambo soils have a total area of 57 ha in the development area. They are moderately well to poorly drained exceedingly stony, sandy loam soils. They usually occur on undulating topography. Silt cappings common on the stones in the C and BC horizons are probably caused by the downward movement of silt from the overlying B horizons.

The Orthic Humo-Ferric Podzol soils usually occur on the top of well-drained slopes. The imperfectly drained Gleyed Humo-Ferric Podzols occur on the lower slopes and bordering depressions; gleying is evident in the profile with some mottling in the B horizon. The Orthic Gleysol soils occur in depressions and along stream channels. They have dull colours and strong mottling due to poor aeration, and are often inundated for long periods during the year.

The Gambo soils are unsuited for agriculture due to excessive stoniness.

A good growth of black spruce and balsam fir represent the dominant trees on the Gambo soils. The ground cover consist of feathermoss and bunchberry.

A detailed description of each of the Gambo soils follows:

Gambo soil: Orthic Humo-Ferric Podzol.

Location: Military Grid Ref. 21 UXD 8250 610.

Vegetation: Good growth black spruce, lambkill, feather moss.

Soil site: Parent Material 1: Skeletal (35% of Particles 2-25 cm), Morainal (Till), igneous and coarse acid and fine acid; parent material 2: coarse loamy and coarse silty (18% clay), morainal (till), igneous and coarse acid and fine acid; parent material 3: fine loamy and fine silty (18 to 35% clay), morainal (till), igneous and coarse acid and fine acid; landform classification: morainal, inclined; slope: 20% slope of class 6 (16-30%), facing east, site at middle position, level microtopography, 500 m long; soil moisture and drainage; moderately well-drained, moderately pervious, moderate surface runoff; very stony; nonrocky; present land use: productive woodland; humus-form: mor and fibrimor and sphagno.

Interpretations: Canadian Land Inventory (CLI) Agriculture: 7/TP.

Special Notes: Washout in a road revealed two parent materials; lower one is compacted and is resisting erosion by a stream. There is an abrupt boundary between C2 and C3. Central Newfoundland Pedoclimatic zone.

- LF 15 to 0 cm; abrupt boundary; 15-25 cm thick.
- Ae 0 to 3 cm; light brownish gray (10YR 6/2 m); sandy loam; very weak, fine, granular; nonsticky, very friable, loose, slightly plastic; few fine roots; many fine pores; 2-12 cm thick.
- Bf 3 to 18 cm; dark yellowish brown (10YR 4/6 m); gravelly sandy loam; weak, fine to medium; subangular blocky and granular; nonsticky, very friable, soft, nonplastic; plentiful fine roots; many fine pores; 10-30 cm thick.
- BC 18 to 48 cm; light olive brown (2.5Y 5/4 m); gravelly loamy sand; few, medium, prominent, yellowish brown 10YR 5/6 mottles; common, medium, faint, pale red 2.5YR 6/2 mottles; weak, fine to medium, platy; nonsticky, friable, slightly hard, nonplastic; few fine roots; few very fine pores; 25 to 35 cm thick.
- C1 40 to 98 cm; grayish brown (2.5Y 5.5/2 m); loamy sand; single grain; nonsticky, loose, nonplastic; few fine roots; many fine pores.
- C2 98 to 198 cm; dark grayish brown (2.5Y 4.5/2 m); gravelly loam; many, fine, prominent dark yellowish brown, (10YR 4/6) mottles; moderate, medium, platy; slightly sticky, firm, hard, slightly plastic; very few roots; few very fine pores.
- C3: 198 to 300 cm; grayish brown (2.5Y 5/2 m); loam; sticky, very firm, extremely hard plastic; very few closed pores; 40% cobbly and stony (bouldery) coarse fragments; smooth abrupt, boundary.

Chemical properties Gambo soil: Orthic Humo-Ferric Podzol

Horizon	pH		Org C (%)	Total N (%)	Exchangeable cations		
	H ₂ O	CaCl ₂			Neutral salt (meq/100g)		
					Ca	Mg	Al
LF	3.2	3.0	50.10	0.88	11.7	4.9	
Ae	2.7	3.5	0.55	0.03	0.1	0.1	0.5
Bf	4.6	4.6	2.63	0.06	0.5	0.1	0.3
BC	4.8	4.7	0.20	0.02	0.1	0.0	
Cl	5.0	4.8	0.04	0.01	0.1	0.0	
C2	4.8	4.6	0.12	0.03	0.3	0.2	0.2
C3	5.2	5.0		0.02	1.5	0.6	

Horizon	Extract	Extract
	Iron	Aluminum
	(%)	(%)
LF	0.0	0.0
Ae	0.0	0.0
Bf	0.2	0.6
BC	0.0	0.1
Cl	0.0	0.1
C2	0.0	0.1
C3	0.0	0.0

Gambo soil: Orthic Gleysol

Vegetation: lambkill, caribou moss, lichen, blueberry, black spruce, burnover young growth of aspen.

Soil site: Parent Material 1: Coarse loamy and coarse silty (18% clay), morainal (till), igneous and coarse acid and shale; Landform Classification: Morainal, inclined; Slope: 3% slope of Class 3 (2-5%), facing east, site at crest position, moderately mounded microtopography, 1000 m long; Soil Moisture and Drainage: poorly drained; slowly pervious, slow and ponded surface runoff, seepage present, 0.2 m to perched watertable; very stony; present land use; unproductive woodland; humus-form: mor and fibrimor and sphagno.

Interpretations: CLI Agriculture: 7/W.

Special Notes: Seepage in B, compacted C horizon; on mounds soils are gleyed podzol; mounds cover about 50% of area.

LH 10 to 0 cm; abundant, fine and medium roots; 10 to 15 cm thick.

Aeg 0 to 10 cm; brown (7.5YR 4.5/2 m) and pinkish gray (5YR 6/2 m) silt loam; weak, fine to medium, subangular blocky; sticky, firm, hard, plastic; few fine roots; few fine pores.

Bg 10 to 25 cm; dark brown (10YR 3/3 m); gravelly sandy loam; few, coarse, prominent mottles; weak, fine to medium, subangular blocky; slightly sticky, friable, slightly plastic; few very fine roots; few fine pores.

Cg 25 cm + ; gray (5Y 6/1 m) and brown (7.5YR 4/4 m) gravelly silt loam; few, coarse, prominent mottles; moderate to strong, medium to coarse, subangular blocky; sticky, firm, very hard; very few micro roots; very few very fine pores.

Chemical properties Gambo soil: Orthic Gleysol

Horizon	pH		Org C (%)	Total N (%)	Exchangeable cations		
	H ₂ O	CaCl ₂			Neutral salt (meq/100g)		
					Ca	Mg	Al
LH	3.6	3.4	55.50	0.86	1.6	0.8	
Aeg	3.7	3.5	2.63	0.08	0.4	0.3	4.2
Bg	4.3	4.1	1.61	0.06	0.2	0.1	1.0
Cg	4.6	4.4	0.11	0.02	2.1	1.2	

Horizon	Extract Iron	Extract Aluminum
	(%)	(%)
LH	0.0	0.1
Aeg	0.1	0.2
Bg	0.0	0.5
Cg	0.0	0.0

Dead Wolf Pond soils

The Dead Wolf Pond soils are derived from sphagnum mosses. They occur as domed and flat bogs. They are nutrient poor and have poor drainage. Most of the domed bogs are deeper than 5 m. They are usually characterized by flashets or ponds grouped in concentric circles around the high centre of the bog. The horizontal bogs are shallow, usually about 1 m deep. Dead Wolf Pond soils cover a total area of 300 ha in the development area.

The domed bogs have been classified as Typic Fibrisol and the flat bogs as Terric Humisol. The domed bogs consist of slightly decomposed peat where plant remains can be identifiable (von Post H1-4). When squeezed, no peat is passed through the fingers. The peat is humified at greater depth.

The flat bogs are shallow and highly humified with very little recognizable plant structure remaining. When squeezed, about two-thirds of the peat escapes between the fingers (Von Post 7-9). Glaciofluvial sands occur at about 1 m.

Vegetation on the Dead Wolf Pond soils consists mainly of Sphagnum spp. with some grasses and sedges, caribou moss, lambkill, Labrador tea and the occasionally stunted black spruce, juniper and white pine.

Some of the domed bogs are suitable for vegetable production and for harvesting of horticultural peat. The flat bogs are highly humified and are not suitable for vegetable production or horticultural peat.

The Dead Wolf Pond soils are unsuitable for fuel peat because of the slight humification in the domed bogs and the shallowness in the horizontal bogs.

A generalized description of the Dead Wolf Pond soils follows:

Dead Wolf Pond soil: Typic Fibrisol.

Location: Military Grid. Ref. 21 UYD 0420 7510.

Vegetation: White pine (few), black spruce, juniper, Labrador tea, caribou moss.

Soil Site: Landform Classification. Domed bog, Slope: 2% simple slope Class 3 (2-5%), site at crest of slope, slightly mounded; microtopography; 10% of area with water.

Special Note: Good for horticultural peat, and for forestry.

Of 0 to 30 cm; 100% sphagnum mosses; von Post, H3.

Of2 30 to 550 cm; 100% sphagnum mosses; von Post, H4;
(Woody material at 550 cm).

Dead Wolf Pond soil: Terric Humisol

Location: Military Grid Ref. 21 UYD 0450 757D

Vegetation: White pine (few), grasses, lambkill, Labrador tea,

Soil Site: Landform Classification: Flat bog; slope: slope class 1
(0-0.5%), site at middle of slope, slightly mounded
microtopography.

Of 0 to 20 cm; 100% sphagnum mosses; von Post, H1

Oh1 20 to 40 cm; 100% sphagnum mosses; von Post, H7

Oh2 40 to 80 cm; 100% sphagnum mosses; von Post, H8;
(charcoal present).

Oh3 80 to 90 cm; 100% sphagnum mosses; von Post, H9.

Cg 90 cm; Sand (outwash material).

Mint Pond soils

Mint Pond soils consist of slightly decomposed peat derived from sedges with some sphagnum mosses. They occur as sloping fens which receive nutrient enriched seepage water from the surrounding mineral soils. They are very poorly drained, shallow, less than 1 m deep, and occupy small areas. They cover a total area of 21 ha in the development area.

The peat is classified as Terric Humic Fibrisol. It consists of slightly decomposed peat which, when squeezed, releases very muddy dark water. No peat passes through the fingers. The plant remains are slightly pasty and have lost some of their identifying features. This is underlaid by a thin humic layer of strongly decomposed peat. Glaciofluvial sands occur at a depth of about 1 m. Ponds or flashets cover up to 30% of the area.

The surface cover consists of a few dwarf black spruce with sedges, some grass, and with some sphagnum mosses.

Mint Pond soils are unsuited for development because of the large surface area of water. They are also difficult to drain and are very shallow.

A generalized description of the Mint Pond soils follows:

Mint Pond soil:	Terric Humic Fibrisol
Location:	Military Grid Ref. 21 UYD 0280 7430.
Vegetation:	Moss with some sedges.
Soil Site:	Sloping Fen; Slope: 2% simple slope Class 2 (0.5-2.0%), site at middle of slope, slightly mounded microtopography; 30% of area with water.
Om	0 to 30 cm; 100% sphagnum; von Post, H5.
Of	30 to 100 cm; dominantly sedge; von Post, H4
Oh	100 to 115 cm; dominantly sedge; von Post, H7
Cg	115 cm; Sand.

SOIL INTERPRETATIONS

Degree and kind of limitation affecting soil uses

The soils are evaluated and placed into interpretative groupings based upon degree of limitation. The interpretations apply to the soils as they are found in their natural states. Because of the inherent moisture deficiencies of these soils, it is assumed that irrigation is available when the soils are evaluated for vegetable production.

Three degrees of soil limitations used are :

Slight-Relatively free of problems, or limitations are easily overcome.

Moderate-Limitations need to be recognized, but can be overcome with good management and careful design; input costs need to be carefully assessed.

Severe-Limitations are severe enough to make use questionable because of costs of overcoming them, or of continuing problems expected with such use.

It should be noted that the rating of "severe" does not mean that the soil must be excluded from a particular use. It only indicates the difficulty of attempting to put the soil into that given use.

Various soil properties are evaluated in establishing the degrees and kinds of limitations for the following uses: cole crop, carrot, and potato production and sprinkler irrigation. Organic soils were evaluated for their limitations for fuel peat, horticultural peat and vegetable production. With these interpretations, it is possible to select from a soils map those sites that have the least limitation for each of the above uses.

These ratings are based solely on soil and landscape criteria. The soil rating indicates the severity of the limitations if the soil is used without corrective or precautionary measures. Socio-economic factors are ignored. The size, shape and location of the soil area are not taken into consideration when it is evaluated for a particular use.

These interpretations could not be adopted regionally due to the limited variation occurring in the soils of Terra Nova Agricultural Development area. For example, in the Terra Nova Agricultural Development area only three textural classes occurred; sand, loamy sand and sandy loam. In a larger area these three classes could have fallen into the same limitation class. The same would be true for other soil properties in this map sheet.

Use of the soil limitation tables

The degree of limitation (i.e. slight to none, moderate, severe) is determined by the most restrictive or severe rating assigned to any one of the listed soil properties. Example: If the degree of limitation is "slight to none" for all but one soil property and its degree of limitation is "severe", then the overall rating of the soil for that given use is "severe". The degree of limitation of the individual soil properties can, however, have a cumulative effect. This applies only to limitation ratings of "slight", if several properties are rated as such, then the overall rating for the soil can be downgraded to "moderate". The same applies to downgrading moderate to severe. The requirements for downgrading a soil's degree of limitation are arbitrary. The severity of the combined effects of several limiting factors will determine whether downgrading is warranted. Caution: It is incorrect to assume that each of the major soil properties influencing use has an equal effect. Class limits for the degree of limitation of individual soil properties were established taking into account and thus, in fact, weighing each property separately, adapted from Wang and Rees (1983).

Soil limitations for sprinkler irrigation

The evaluation of land for irrigation suitability involves an evaluation of physical, economic and sociological factors. Economic and sociological factors such as the kind of crop grown, monetary returns and engineering problems such as size of pump, etc., were not considered in this evaluation. The feasibility of using irrigation was not the concern of this report. Physical factors, such as soil, water and climate determine the capability of an area to produce crops. Climate is an uncontrollable factor and it is assumed that regionally adapted crops will be grown. Most of soils evaluated in this report have moisture deficiencies due to their coarse texture. The soil properties evaluated were: texture, drainage, topography, stoniness, and structure.

See Table 2 for criteria used in rating soils for sprinkler irrigation.

Table 2. Soil suitability for sprinkler irrigation.

Major occurring soil Properties influencing suitability	Degree of limitation		
	Slight to none	Moderate	Severe
Texture	Sandy Loam	Loamy Sand	Sand
Slope	0 - 5%	5 - 9%	9 - 15%
Stoniness	S0, S1 (stones 10-30 meters meters and greater apart)	S2, S3 (stones 1-10 meters apart)	S4 (stones 0.7-1.5 apart)
Depth to cemented layer (moderately restricting water movement)	50 cm	20-50 cm	10-20 cm
Drainage	Rapid to good to imperfect	Moderately well	Poor

Soil limitations for potatoes

Because of the droughtiness of the soils, irrigation is assumed to be "normal" practice in growing potatoes on these soils. The socioeconomic factors were not evaluated. Rating is done on soil properties that would affect the production of potatoes. The soil properties used in determining the soil limitations were surface coarse fragments (cobbles, stones and boulders), texture, slope, structure and drainage. The presence of cobbles and stones would create a problem for mechanized harvesting. The large number of stones and cobbles would make it labour-intensive and cost-prohibitive. The depth and degree of the cemented layer is an important factor, since the depth of the soil above the layer has to be great enough for the plough to make hills. The depth of cemented layer suitable for ploughing would depend on the degree of cementation. If it was strongly cemented, conventional ploughs could not break through the cemented layer.

See Table 3 for criteria used in rating soils for potatoes.

Table 3. Soil limitations for potatoes (assuming irrigation is used).

Major occurring soil Properties influencing suitability	Degree of limitation		
	Slight to none	Moderate	Severe
Surface coarse fragments			
(a) Cobbles (7.5-15 cm in diameter)	0 - 3%	3 - 15%	15 - 50%
(b) Stones (15-60 cm in diameter)	S0, S1 (stones 10-30 meters apart)	S2, S3 (stones 1-10 meters apart)	S4 (stones 0.7-1.5 meters apart)
(c) Boulders (60 cm+ in diameter)	B0 (no boulders)	B1, (boulder 10-30 meters apart)	B2, (boulders 0 meters apart)
Surface texture	Sandy loam	Loamy sand	Sand
Slope	0 - 5%	5 - 9%	9 - 15%
Depth to cemented layer	50 cm	20 - 50 cm	0 - 20 cm
Degree of cemen- tation	None to weak	Moderate	Strong
Drainage	Moderately well	Imperfect	Poor

Soil limitations for carrots

The production of carrots on these soils would require irrigation. Socioeconomic factors are not considered for carrot production. The most important factor in carrot production is to have marketable quality. The major soil properties affecting this is the amount of gravel and cobbles in the soil. The removal of gravel and cobbles would be very labour-intensive. Other criteria used for rating the soils were stones, boulders, surface texture, slope, depth to cemented layer, degree of cementation and drainage.

See Table 4 for criteria used in rating soils for carrots.

Table 4. Soil suitability for carrots (assuming irrigation is used).

Properties influencing Suitability	Degree of limitation		
	Slight to none	Moderate	Severe
Surface coarse fragments			
(a) Gravel (diameter 2.0 mm to 7.5 cm)	0 - 5%	5 - 25%	25 - 50%
(b) Cobbles (diameter 7.5 - 15 cm)	0 - 3%	3 - 15%	15 - 50%
(c) Stones (diameter 15- 60 cm)	S0, S1 (stones 10- 30 meters apart)	S2, S3 (stones 1-10 meters apart)	S4 (Stones 0.7- 1.5 meters apart)
(d) Boulders (60 cm+)	B0, (no boulders)	B1 (boulders 10-30 meters apart)	B2 (boulders 10 meters)
Surface texture	Sandy loam	Loamy sand	Sand
Slope	0 - 5%	5 - 9%	9 - 15%
Depth to cemented layer	50 cm	20 - 50 cm	0 - 20 cm
Degree of cemen- tation	None to weak	Moderate	Strong
Drainage	Rapid to moderate	Imperfect	Poor

Soil limitations for cole crops

The quality of cole crops, which include cabbage and other brassica, are less affected by gravel and cobbles than root crops such as carrot and potato. This is due to the fact that cole crops grow on the soil surface. The major soil property affecting the production of cole crops is the depth to cemented layer, and degree of cementation. The depth has to be great enough and the cementation weak enough to allow ploughing. Other criteria used for rating the soils are surface coarse fragments (cobbles, stones and boulders), surface texture, and slope and drainage.

See Table 5 for criteria used in rating soil for cole crops.

Table 5. Soil limitations for cole crops (assuming irrigation is used).

Major occurring soil Properties influencing limitations	Degree of limitation		
	Slight to none	Moderate	Severe
Surface coarse fragments			
(a) Cobbles (diameter 7.5 cm to 15 cm)	0 - 15%	15 - 50%	>50%
(b) Stones (diameter 15 to 60 cm)	S0, S1 (stones greater than 10 meters apart)	S2, S3 (stones 1-10 meters apart)	S4 (stones 0.7-1.5 meters apart)
(c) Boulders (diameter 60 cm+)	B0, B1 (boulders greater than 10 meters apart)	B2 (boulders 2-10 meters apart)	B3 (boulders 1-2 meters apart)
Surface texture	Sandy loam	Loamy sand	Sand
Slope	0 - 5%	5 - 9%	9 - 15%
Depth to cemented layer	50 cm	20 - 50 cm	0 - 20 cm
Degree of cemen- tation	None to weak	Moderate	Strong
Drainage	Moderately well	Imperfect	Poor

INTERPRETATION OF ORGANIC SOILS

Organic soils have been used for production in Newfoundland since the 1950s where they were first developed for pastureland. Since that time, considerable amount of research has been done at Colinet by the staff of Agriculture Canada on developing peat for vegetable and forage production. Work has also been done recently on developing peat for carrot, celery and lettuce production. A number of peat bogs have been developed for horticultural peat on a small scale.

Memorial University along with the Federal government and private industry, has recently developed a bog for fuel peat at Botwood. The peat is to be supplied to Price for their paper mill at Grand Falls.

It is through this research work that guidelines were able to be established for peat development in Newfoundland.

Organic soils were evaluated for their limitations for horticultural peat, fuel peat and vegetable production.

The major soil properties used for rating organic soils for various purposes were degree of decomposition, depth of the deposit, percentage of areas with ponds, drainability and the presence of roots in the deposit. Socioeconomic factors were not considered.

The optimum degree of decomposition varies with the use of peat. The decomposition rating is based on the von Post scale of humification. The degree of humification is divided into 10 categories, with H1 being undecomposed peat and H10 being completely decomposed peat. The von Post method of determining the degree of humification is described in the following (Henderson and Doiron 1981):

- H1 Completely undecomposed peat which, when squeezed, releases almost clear water. Plant remains are easily identifiable. No amorphous material present.
- H2 Almost completely undecomposed peat which, when squeezed, releases clear or yellowish water. Plant remains are still easily identifiable. No amorphous material present.
- H3 Very slightly decomposed peat which, when squeezed, releases muddy water, but no peat passes between the fingers. Plant remains are still identifiable, and no amorphous material present.
- H4 Slightly decomposed peat which, when squeezed, releases very muddy dark water. No peat is passed between the fingers but the plant remains are slightly pasty and has lost some of the identifiable features.
- H5 Moderately decomposed peat which, when squeezed, releases very muddy water while a very small amount of peat escapes between the fingers. The structure of plant remains is quite indistinct although it is still possible to recognize certain features. The residue is strongly pasty.
- H6 Moderately to strongly decomposed peat with a very indistinct plant structure. When squeezed, about one-third of the peat escapes between the fingers. The residue is strongly pasty but shows the plant structure more distinctly than before squeezing.
- H7 Strongly decomposed peat. Contains a lot of amorphous material with very faintly recognizable plant structure. When squeezed, about one-half of the peat escapes between the fingers. The water, if any is released, is very dark and almost pasty.

- H8 Very strongly decomposed peat with a large quantity of amorphous material and very indistinct plant structure. When squeezed, about two-thirds of the peat escapes between the fingers. A small quantity of pasty water may be released. The plant material remaining in the hand consists of residues such as roots and fibres that resist decomposition.
- H9 Practically fully decomposed peat in which there is hardly any recognizable plant structure. When squeezed, almost all the peat escapes between the fingers as a fairly uniform paste.
- H10 Completely decomposed peat with no discernible plant structure. When squeezed, all the wet peat escapes between the fingers.

The production of peat relies greatly on the depth of the deposit. For mining purposes, the minimum depth would be 2 m. The minimum depth of the peat deposit for vegetable products depends on the underlying material.

The underlying material is a factor affecting all uses of the peat deposit. On deeper deposits that are to be mined, the underlying material is important to determine the use of the area after the peat has been mined. On shallow peat used for agricultural development, the kind of underlying material could affect the drainage. A sandy subsurface could facilitate drainage; if the bog was used for vegetable production the sandy subsurface material could be incorporated into the peat to make a more manageable and productive soil. Humic material in the underlying soil could create problems with drainage and use.

Drainability of the peat depends on several factors. Landform influences the ease of drainage. A domed bog is easier to drain than a horizontal bog. Organic soils with long slopes facilitate longer drains, thus there are fewer crossings for field equipment. Drainage is also affected by the surrounding mineral soil and the impediments that the land would have on draining the peat.

The frequency of ponds (flashets) presents problems for development; if they are too numerous drainage would be impractical. Five percent of surface area in ponds is considered the maximum acceptable for development (Rayment 1982; Rees 1982).

The presence of tree cover could create a problem on some bogs. Tree roots and woody material in the peat and the hardness and depth of the woody material in the peat deposit are physical hindrances to reclamation and production.

Organic Soil limitations for horticultural peat

The major soil properties affecting the limitations of organic soils for horticultural peat are the degree of decomposition and the depth of the deposit. The optimum degree of decomposition should be H-3 on the Von Post scale and the depth should be greater than 2 m. Other factors to be considered are the number area of flashets and the drainability of the peat. The presence of tree cover and roots and woody material were not considered because of their absence in the Organic soils in the map sheet. Socioeconomic factors were not considered.

See Table 6 for criteria used in rating organic soils for horticultural peat.

Table 6. Organic Soil limitations for horticultural peat.

Major occurring soil properties influencing limitations	Degree of limitation		
	Slight to none	Moderate	Severe
Degree of decomposition	H1-4	H5-6	H7-10
Depth of the deposit	2 m	1-2 m	1 m
Area of flashets	0 - 2%	2 - 5%	5%
Drainability	Good	Fair	Poor

Organic Soil limitations for fuel peat

A good fuel peat must be highly decomposed and of low ash content. The deposit should be at least 2 m deep. Other factors which affect the development of the peat are number of flashets and the drainability. The presence of tree cover and roots and woody material in the peat did not present a problem in the surveyed area. Socioeconomic factors were not considered.

See Table 7 for criteria used in rating organic soils for fuel peat.

Table 7. Organic soil limitations for fuel peat.

Major occurring soil properties influencing limitations	Degree of limitation		
	Slight to none	Moderate	Severe
Degree of decomposition	H-6, 7 & 8	H-4, 5 & 9	H-1, 2, 3 & 10
Depth of the deposit	2 m	1-2 m	1 m
Area of flashets	0 - 2%	2 - 5%	5%
Drainability	Good	Fair	Poor

Organic Soil limitations for vegetable production

The biggest consideration in selecting an organic soil for vegetable production is the drainability of the area and the amount of the area having flashets. The degree of decomposition is a minor factor since the fibric material will decompose with cultivation. It is assumed that regionally adapted vegetables are to be grown.

See Table 8 for criteria used in rating organic soils for vegetable production.

Table 8. Organic soil limitations for vegetables.

Major occurring soil properties influencing limitations	Degree of limitation		
	Slight to none	Moderate	Severe
Degree of decomposition	H 3-5	H1, 2 & 6	H7 - 10
Depth of deposit	0.5 - 2 m	2 m	0.5 m
Area of flashets	0 - 2%	2 - 5%	5%
Drainability	Good	Fair	Poor
Underlying materials	Sand	Gravel, bedrock, stones, silt, and clay and water.	Humic material,

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APPENDIX

Common and Botanical Names of plants

balsam fir	<u>Abies balsamea</u> (L.) Mill.
black spruce	<u>Picea mariana</u> (Mill) B.S.P.
blueberry	<u>Vaccinium angustifolium</u> Ait.
bunchberry	<u>Cornus canadensis</u> L.
caribou moss	<u>Cladonia</u> spp.
cotton grass	<u>Eriophorum chamissonis</u> C.A.
eastern white pine	<u>Pinus strobus</u> L.
feathermos	<u>Pleurozium schreberi</u> (BSG.) Mitt.
larch, American	<u>Larix laricina</u> (Du Roi) K. Koch
lambkill	<u>Kalmia angustifolia</u> L.
sedge	<u>Carex</u> spp.
speckled alder	<u>Alnus rugosa</u> (Du Roi)
sphagnum moss	<u>Sphagnum</u> spp.
white birch	<u>Betula papyrifera</u> Marsh.

MAPS NOT

FILMED

CARTES

OMISES